RIODICAL
AUG 17 1960

CURRENT AFFAIRS BULLETIN

No. 27 April, 1960

AD
Library

CONTENTS

The Measurement of Fishing Power 1

General Trends:

- Water Hyacinth 10
- Plastic Sheets 10
- Netherlands Trawler 11
- Electronic Harpoon 11
- Freshness of Fish 12
- Fish Visceral Meal 12
- Fish Oil Resin 13
- Algae as Human Food 13
- Ivory of the Ocean 14

News from Member Governments:

- Australia 15
- Australia: Papua & New Guinea 18
- Cambodia 20
- Ceylon 20
- France: French Polynesia 22

— Contents continued overleaf —

INDO-PACIFIC FISHERIES COUNCIL

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

BANGKOK THAILAND

News from Member Governments:

India 23
Indonesia 23
Japan 24
Korea 25
Federation of Malaya 25
Netherlands: New Guinea 25
Philippines 26
South Pacific 27
Thailand 27
United Kingdom: North Borneo 28
Hong Kong 29
United States of America: Hawaii 30

FAO Activities:

Resignations 31
Appointments 31
Staff Movements 31
Technical Assistance 31
Fellowships 32

IPFC Affairs 33

Personalia 33

Current Reading 35

Meetings and Conferences 37

Forthcoming Meetings and Training Centers 40

THE MEASUREMENT OF FISHING POWER AND ITS RELATION TO THE CHARACTERISTICS OF VESSELS

By

Biology Branch, Fisheries Division, FAO, Rome
B.B. Parrish
(Marine Laboratory, Aberdeen)
R.S. Keir
(Biologist-Statistician, ICNAF)

EXPLANATION AND SUMMARY

Preparation of this paper followed a suggestion made during the 1958 Annual Meeting of ICNAF that a simple account be prepared of the results of research on the performance of fishing units conducted for purposes of resource assessment and fisheries management. The paper defines the fishing power of a fishing unit and describes how it is measured by comparative fishing trials and analysis of catch and effort statistics. The results obtained in correlating fishing power with measurable characteristics of the craft are briefly summarised and the uses to which this information is put for purposes of resource assessment and management are outlined. Needs for future studies are discussed.

INTRODUCTION

Measurement and analysis of the performance of fishing units has interested fisheries scientists since they first started, towards the end of the nineteenth century, to examine statistics of fish catches and measure the sizes of fish caught in an endeavour to understand why intensive fishing sometimes became unprofitable, and to find remedies for this condition. They have therefore been trying to discover and understand the quantitative relations between fishing activities and the sizes and compositions of exploited fish stocks, and of the catches obtained from them, with the principal aim of predicting the changes in fishing activity that will result in better catches.

Fishing activities comprise a collection of discrete operations by fishing units (each consisting of vessel, gear and crew). During each operation an input of **fishing effort** results in an output of **catch**. Measurement of these two elements – effort and catch – provides the basic information used for the assessment of fish stocks. For this purpose, effort and catch data for single operations have to be combined in such a way that the sum of the catches divided by the sum of the efforts in a given area and over a given period is a proportional index of the average amount of commercial-sized fish present in that area during that time. If it were possible to measure stock abundance directly, and in absolute terms, by the use of echo sounders, underwater cameras, or other such instruments, we should be able to determine the appropriate unit of fishing effort for this purpose. In the absence of such knowledge it has been usual to attempt to foresee the factors of effort variability which could result in non-proportionality of catch-per-unit-effort and fish density. The hypothesis that

Reprinted from Annual Proceedings, Vol. 9, International Commission for the Northwest Atlantic Fisheries, pp. 106 to 112, 1959.

any given factor does indeed have such an effect in practice is then examined experimentally by the methods described in later sections of this paper; if the factor does not introduce an effect large enough to affect the estimates significantly, then that factor is ignored in further treatment of the data. If the effect is great enough to be thus measured, the factor can be taken into account in devising an appropriate standard measure. It is in this manner that for certain fisheries there has been a progressive modification of the effort unit for trawlers as follows: number of trips, days absence from port, days spent fishing, hours spent fishing, number of steam-trawler ton-hours spent fishing. (See later.)

The compilation of catches presents no special problems other than the identification of the stock from which they are taken; in general the catches must be of the same kind—species, subspecies, or perhaps race—and refer to the same condition of product, e.g., whole fresh fish. For the latter purpose, simple conversion by factors is usually satisfactory.

Effort data are not so easily combined. Not all unit operations are quantitatively equivalent; thus one haul by a big trawler obviously does not represent the same amount of effort as one by a small trawler. Because the size compositions of fleets vary, because there is a tendency for small trawlers to operate in different places from large ones, and because the species composition and the size composition of the catches of small and large vessels differ, some adjustment must be made to the effort units before they can be compiled. Of course there are many factors other than vessel size which affect catches and which must be taken into account when they vary.

It is therefore necessary to establish standard units of fishing effort so that we may say that on the average X operations by fishing unit A are equivalent to Y operations by unit B. By equivalent we mean no more than that if the two units A and B could fish at exactly the same time and place, A would catch in X operations the same amount and kind of fish that B would catch in Y operations.

Before examining how such relations are discovered, we should mention two points. Firstly an aim in selecting effort units is to obtain a measure of effort which is related in a known way, and preferably directly and simply, to the physical characteristics of the system the processes within which are being analysed. Thus a good unit of effort might be proportionally related to the area of ground or volume of water "covered" or "explored" by the gear during an operation and hence simply related to the probability that a fish present in the area at the time will be captured, and thus be related in a simple manner to the **fishing mortality** caused in the fish population by each operation.

Secondly it should be noted that while standard fishing effort measurements are used to determine the condition of the stock and to analyse its dynamic properties of change in size, composition and yield in response to exploitation, the standards might be required to specify desirable amounts of fishing effort if the analysis shows that some control of the fishing activity would be beneficial to the industry, politically desirable and administratively possible.

DEFINITION OF EFFORT

A measure of effort which often satisfies the above conditions is, for any

fishing unit, the product of the **fishing power** of the fishing unit (i.e. its catching power) and the period of **time** during which it operates. These therefore constitute the two elements of the unit of effort. The total effort exerted by the fleet of fishing units operating in a fishery is the sum of these products for all the units comprising the fishing fleet. The primary tasks in effort measurement for any fishery are therefore first to choose the appropriate time unit for the particular method of fishing engaged in the fishery, and secondly to measure the fishing powers of the units. The time unit may refer in cases where fishing is "blind", as with trawlers not carrying fish detection instruments, to the time during which the gear acts; for other kinds of fishing the time spent searching for fish is more appropriate; probably in most cases a function containing measures both of "searching time" and of "fishing time" appropriately weighted, would be better.

In practice, the **absolute fishing power** of a fishing unit cannot usually be determined, because the absolute abundance of fish in the locality fished is not known. All that can be measured are indices of **performance** (e.g. catch per unit operation) of the fishing unit under the particular circumstances of the fishing operations. The performance of a unit will vary from place to place and from time to time as a result of variations in the abundance of fish and other external factors, so that this cannot be used as an index of fishing power for computing total effort. Instead, it is necessary to measure **relative fishing power,** defined as the ratio of the performance of one fishing unit to that of another operating under the same external conditions (abundance and composition of fish, etc.). The total effort exerted by the fleet can then be computed in terms of one component of the fishery (e.g. steam trawlers of a certain size, seiners, etc.) whose fishing power is taken as unity, the effort units of the other components being adjusted by their relative fishing powers. The relative fishing powers may refer to groups within a single class of fishing units (e.g. motor trawlers of different sizes), to classes of units within a single gear fishery (e.g. steam and motor trawlers) or to different components of a mixed gear fishery. The complexity of the task is a function of the heterogeneity of the fleet and the extent to which its composition changes with time or place.

A consequence of this concept of fishing-effort is that separate effort units and relative fishing powers may apply for the different species of fish caught in a mixed species fishery; the relative fishing powers of two units or groups of units may differ markedly for different species of fish.

The Measurement of Relative Fishing Power

The relative fishing power of a unit is the ratio of its performance to that of another unit under identical conditions. The method of measurement must therefore involve the analysis of the catches of vessels working at the same time and place, in their normal manner. An assumption made here is that different units fishing apparently at the same time and place are fishing on stock of the same density. Whether this is so can be tested only by having direct estimates of stock density or by searching for differences in catches, such as their size composition, which would

indicate that the different units are really fishing different groups of fish. It is necessary to assume that such a difference does not exist, until it is detected; interpretation of data for fishery assessment purposes does not however usually depend critically on the validity of that hypothesis. In testing it by examination of catch compositions it is necessary to know, and to take account of, inherent differences in the selectivity of the various units.

One method of undertaking such comparisons is carefully controlled comparative fishing experiments using two or more vessels. With this procedure allowance can be made for the effect of variations in external conditions such as the size and composition of the fish concentrations, the nature of the sea-bed, wind and tide, all of which modify the performance of fishing units. Since many of the characteristics of the fishing units can be carefully measured and controlled, such experiments also provide information on the causes of the observed differences in fishing power.

The relative fishing powers of all units of the fishing fleet could, in principle, be determined from the results of many such experiments in which either one unit is used throughout as standard (e.g. a research vessel) or successive comparisons are made between different pairs of units of the fleet (e.g. A is compared with B, B with C, C with D, and so on). They would be accurate and highly informative, but also time-consuming and costly. For reliable estimates of relative fishing power numerous haul replicates are required in each experiment, and these have to be repeated under different external conditions.

In practice, especially in large mixed fisheries, it may be necessary to adopt a different method of measurement. This is the analysis of the records of commercial fishing operations giving detailed statistics of the catches of each species of fish and efforts of the various fishing units, by short time periods and for small subdivisions of the fishing area. Comparisons are made of the performances of groups of units fishing in the same area at the same time. The applicability and precision of this method for any fishery are governed by the statistical breakdown: the smaller the area and time subdivisions in which statistics are given, the less is the danger of variable external circumstances influencing the relative performances of the fishing units. This method is less costly and time-consuming than comparative fishing experiments, and estimates can easily be made for all seasons and localities fished. It is not applicable, of course, in fisheries in which different components of the fleet are segregated on the fishing grounds. This is sometimes the case for the vessels of different countries and those using different types of gear. In such instances, the first method must, if possible, be used to make the comparison between the segregated types of units. In any case it is probably best in practice to employ both methods and compare the results obtained from them.

Where fishing units of similar types but different powers operate on different grounds for such reasons as differences of working range, then comparison of operation statistics cannot give the required estimates of power factors, but in such situations the costlier method of comparative fishing is available. When, however, different gears are used

on different grounds for some reason connected with their fundamental method of action, quite a different situation is presented. There are varying degrees of possible segregation, extreme cases being offered by fixed stake traps and otter trawlers exploiting the same stock in adjacent but quite separate areas without any overlap.

Resolution of the problem of the correct procedure in such cases can only come from knowledge of the relative concentrations of fish actually available to the fishing units. Meanwhile, it seems better to use apparent relative fishing power factors derived from catch and effort statistics than not to attempt to bring effort to a common standard, but the implications and consequences of this need further study.

Factors Governing Fishing Power.

Ideally, the measurement of total fishing effort exerted in a fishery should involve determination of the relative fishing power of each unit in the fleet. This is seldom possible in practice, and experience has shown that it is usually not necessary. For a large fleet it is impracticable to conduct a comprehensive series of comparative fishing experiments, and in the method of comparing commercial statistics there is a considerable chance variation in the estimated fishing powers of individual units. The fishing powers of units having similar characteristics with regard to vessel, gear and number of crew, however, are not usually found to differ markedly. That is to say, the differences between the fishing powers of fishing units of clearly identifiable types are greater than the differences between units of the same type which differ in the skill of the skipper or other more subtle ways. The main task is therefore to identify factors closely correlated with fishing power variations within the fleet, and to measure the effects of each.

Some guidance to the identification of these factors can be obtained by a close examination of fishing practices. For convenience, the possible factors might be grouped in the following categories:

(1) Vessel characteristics

(2) Gear characteristics

(3) Crew characteristics (e.g. number, skill in operating gear, etc.)

In practice the various factors in either the same or different categories, will not vary independently. For example, size and power of vessel and type or size of gear often vary together. In such instances, the fishing power might be expressed in terms of that factor which is most easily measured.

The factors of particular relevance for this paper are those falling within the "vessel" category, and it is in relation to these that most fishing power assessments have been made, especially for trawlers. The two most obvious vessel characteristics which have been investigated are "size of vessel" and "propulsive power", and some examples of the results obtained are given below.

Some Results

The following statements summarise findings reported in the publications listed at the end of this paper.

For British and German North Sea steam trawlers, fishing power has been found to increase with gross tonnage and with overall length for all demersal species. It is more nearly directly

proportional to the former, and proportionality is a desirable property because it simplifies computation of fishing effort, as "steam-trawler ton-hours." The fishing power of British motor trawlers working in the same area is also proportional to gross tonnage but the constant of proportionality is in this case higher, so that one-ton-hour fished by a motor trawler is equivalent to about 1.4 ton-hours fished by a steam trawler. Comparative fishing experiments with research vessels have confirmed this relation. The fishing power of a motor trawler is also quite closely proportional to the brake-horse-power of its engine. The proportional relations described above do not seem to hold for vessels of all sizes. Icelandic motor trawlers, averaging 660 gross tons and 1,000 horse-power and used for catching cod, have only 40 percent more fishing power than those in the 320-ton class with 625 horse-power engines.

Significant correlations have been found between fishing power and gross tonnage, and fishing power and horse-power of U.S. motor trawlers working on Georges Bank in the north-west Atlantic.

In the cases of Dutch motor and steam herring trawlers, and motor cutters trawling for demersal fish in the North Sea, the correlation of fishing power with horse-power is much better than with tonnage, and it appears from statistics that new motor trawlers have higher fishing powers than older trawlers of the same tonnage and horse-power. A detailed analysis has been made of English statistics from this point of view but significant effects of age or year of construction were not apparent. By comparing performances of ships of the same class it is possible to examine the variability due to crew differences but little work has so far been done along these lines. Gulland has put forward arguments, based on an examination of data for British trawlers, indicating that although it may be that the better skippers tend to be in bigger or newer boats than the less skilful ones, the effect of this in increasing the fishing power of the bigger units is not so great as the direct effects of size of unit.

Studies are now being made of some fisheries by more refined statistical methods, to determine the interdependence of the different factors, particularly those expressing size of unit. Thus it seems that for trawlers fishing power increases with length, horse-power, and tonnage; it increases with headline length, and faster than vessel length, but slower than tonnage, so that it would appear that engine power increases in such a way with size that bigger trawlers tow faster than smaller ones, but less than proportionally with their tonnage. These results are highly variable, however, with regard to differences in species, fish density and conditions of operation.

Inove and Watanabe (1958) have examined the catches per day of 97 Japanese drift-net vessels fishing from Awa-Gun for Saury (*Cololabis saira*). Within each gross tonnage class, 10-19, 20-29, 30-39, 50 + tons, are given relative fishing power factors, engine horse-power, number of crew and number of days spent fishing within a certain period. Vessels over 30 tons (mean, 57 tons) caught 67 percent more fish on the average than those of less than 30 tons (mean, 23 tons).

Within each of the four tonnage classes, however, there was no trend of

power factor with tonnage, nor with horse-power nor crew number. Their data suggest that within each tonnage class the boats with higher fishing power fished for more days during the period, but boats over 30 tons did not fish more days than those below 30 tons.

Some preliminary studies have been made of the effect of variations in the mode of operating the same fishing unit. For example, increases in towing speed of a Dutch trawler resulted in decreased in catches of flatfish, especially plaice. Studies have been made to gain understanding of the changes in fishing power which seem to occur when the cod-end mesh size of a trawl is altered. Such changes differ considerably for different fish species—thus catches of one may be increased and of another, decreased.

For Scottish seiners catching demersal fish there may not be a relation between fishing power and size of vessel; one day's fishing by any one seiner seems about equivalent to one day by a 350-ton trawler in terms of whiting catches. Differences in culling practice between trawlers and seiners, or ineffective mesh size, may however be affecting the statistics used for this comparison, and would have to be considered before the results were applied in practice.

In comparisons between different kinds of gear, the "area swept" by the gear may be computed when it is difficult to define equivalent fishing times. For example, time spent trawling is easy to measure, but the duration of a seine haul is more difficult to define. However, Scottish seiners work in such a way that in each operation the gear sweeps out an area of about six or seven million square feet, which is about the same as that swept by a 30-foot trawl with 30-fathom sweeps towed at 3 knots for 2½ hours. In terms of catch per calculated area swept, it is found that the seiner has, for all demersal species, a fishing power about half that of the trawler, but if catches of small whiting alone are considered, its fishing power is found to be 30 percent greater than that of the trawler.

CONCLUSION

The relative fishing powers of fishing units within a group, together with specifications of the structural and operational features of the fishing units, constitute the basic information with which critical examination of fishing capacity and performance may be attempted, using the techniques of correlation and analysis of variance. Findings of the kind outlined above can be used to bring the fishing effort statistics of a heterogeneous fleet to a common standard; the most important criterion of usefulness of a discovered relation for this purpose is whether it is a proportional one, since the adjustment of crude statistics is then a simple routine task.

The factors causing differences of fishing power cannot be identified with certainly by these purely statistical methods but clues may be obtained that can help in the design of critical experiments. Such experiments are in principle the same as the comparative fishing tests except that some deliberate and usually small changes will be made in the structure or operation of one of two otherwise similar units, or the same unit may make alternate operations with and without the modification. This will be done to test a particular hypothesis as to the magnitude of the

effect of a particular factor in determining the fishing power of the type of unit being studied. A special case of this kind is a gear selectivity experiment with, say, alternate hauls of a trawl using cod-ends of differing mesh size to test the hypothesis that changes in power ratios with increasing size of fish are proportional to the maximum girth of the fish and hence to its ability to escape through the meshes. It should be noted, in this connection, that such experiments revealed the inter-dependence of selectivity and fishing power; thus, increasing the cod-end mesh of a trawl to permit small fish to escape can also increase the fishing power with respect to large fish, and this even when the towing speed is apparently unchanged. The relative change in fishing power thus caused differs for different species in the catches so that the species compositions of large fish, as well as the size compositions and the total effective effort exerted by a given fleet, are also altered to some extent.

The increased attention being paid to fish girth in net selection studies is a good example of a change in emphasis in gear research towards closer study of causative factors. There has been little sign so far of a corresponding change in studies of the factors relating to the vessel itself, or to the crew. Only the crudest of physical measures, such as gross tonnage, overall length and horsepower, have been examined for their relation with fishing power of trawlers. It seems opportune now for naval architects and marine engineers to contribute to this work.

Those scientists who have started the kind of work described above have often not been familiar with the several different ways in which the characteristics, such as vessel length or displacement, which they have chosen for consideration are measured in practice; yet one measure of engine power may be much more closely related to fishing power than another. Surely there are other characteristics of craft, perhaps more complex functions of the apparently simple attributes of hull size and engine power, and of other attributes, which are more appropriate for scientific studies of fishing power?

The methods for comparing performance, which have been quite highly developed for purposes of stocks assessment and fisheries regulation, may be worth considering as tools for improving vessel design, though they would need to be elaborated to cover the comparisons of overall performance rather than just performance at the fishing site. One word of warning is, however, necessary with regard to this question. Experiments carried out so far give data of a complexity quite sufficient to show that it is the whole fishing unit and its mode of operation, rather than craft or gear, which must be considered in the analysis. We must not forget that the catch of fish in a particular operation is the result of a complex interaction between the behavioural characteristics of the fish, the hydrodynamic properties of the gear, the kinds of forces exerted by the vessel, and the conditions of the sea at the time, which affect the behaviour of craft, gear and fish. Big trawlers catch more fish than small ones, and roughly in proportion to their sizes but such a statement appears to be near the limit to which we can regard catching fish,

even by trawl, as a mechanical process of "sweeping" a certain area or volume. For other types of gear and methods of fishing, it is even more difficult to make quantitative statements with any security.

FURTHER READING

BEVERTON, R.J.H. and S.J. HOLT. 1957. On the dynamics of exploited fish populations. *Fish. invest., Lond.*, Ser. II, 19: 533 p.

BEVERTON, R.J.H. and B. BPARRI S.H. 1956. Commercial statistics in fish population studies. *Rapp. Cons. Explor. Mer.*, 140 (1): 58-66.

GULLAND, J.A. 1956. On the fishing effort in English demersal fisheries. *Fish. Invest., Lond.*, Ser. II, 20 (5): 41 p.

INOVE, M. and K. WATANABE. 1958. The fishing power of saury blanket net (Bouke-Ami) fishery. *Bull. Jap. Soc. Sci. Fish.*, 23 (12): 745-748.

POPE, J.A. 1955. Fishing power and fishing effort of vessels landing at Aberdeen. Paper presented to Comparative Fishing Committee, I.C.E.S.

Papers on fishing effort submitted to the Joint Scientific Meeting of ICNAF/ICES/FAO, May/June 1957, Lisbon.

CORRIGENDA

In the CAB, issue No 25, the following corrections should be made on p.4. The last 3 lines of the 3rd paragraph in column 2 should be appended to the last line in column 1 and the last line in column 1 should read "due to school laws, all fishermen are literate and many with a very good education are attracted to the trade because of good earnings".

In column 2, the first five lines of the 3rd para should precede the first line of the first para and the sentence should read "The Far East countries present a different picture as there has been very little development of gear and method; the gear used today is the same as was used hundreds of years ago and in most cases inefficient by modern standards. The fishermen are poor....."

Water Hyacinth: a Curse or a Crop?

Water hyacinth (*Eichornia crassipes*) which is very common in south-east Asia, the Nile, and the Congo is usually regarded as a curse. It is by no means certain that its eradication will be successful, so that it may be prudent to try to find whether it may be useful. Water hyacinth produces a pure stand and acres of water that hitherto carried little plant-life can carry a rich growth. This makes the plant resemble a crop rather than a weed and a use for it has to be found. A floating plant is ideally adapted for mechanized harvesting but possible uses for water hyacinth have not been intensively sought. Cattle will eat it and it is used as pig food in south-east Asia. It has been fermented to give methane and compost. Freshly harvested water hyacinth contains 95 percent water which is a disadvantage for many uses, but is a great advantage if it should prove possible to use the leaf as a source of extracted protein, because general experience suggests that protein extraction is easier from wet than from dry leaves. The basic principle of leaf protein extraction is very simple; the fresh leaf is pulped and the juice, neutralized if necessary, is separated. It carries with it much or most of the protein, and this is coagulated and filtered off as a dark green cake which generally has little flavor after washing with water It can be used as it stands in various dishes that are reasonably palatable, or a stable protein can be made by extracting the chlorophyll and lipids with a solvent. So many species of leaves have now given satisfactory yields of protein that there is good reason to expect that it could be extracted from water hyacinth. But this has not, apparently, yet been demonstrated. This is a plea for some re-orientation of thinking in areas suffering from, or threatened with water hyacinth. There is a case for directing some research towards finding uses for this pest instead of concentrating all efforts on its eradication. The practicability of the uses mentioned above has not been established and difficulties may arise with some of them. But the quantity of water hyacinth is now so large, and so much effort is already being put into dragging it from waterways, that it would seem reasonable to set up a unit to study all the possibilities. (*Abstracted from*: Pirie, N.W. WATER HYACINTH: A CURSE OR A CROP. *Nature*, p. 116, 9 Jan. 1960).

Plastic Sheets for Oysterbeds

Many bottom areas and estuarine regions are too soft to support oysters or their shells. To convert these areas into oyster beds, thousands of bushels of oyster shells have to be planted on each acre to harden to bottom. This is an expensive undertaking, rendering the method virtually impractical. Nevertheless, problems of this nature have to be met in extensive areas when establishment of oyster beds is desirable in regions where the bottoms are to soft. The problem can be solved by covering soft bottoms with a thin sheet of polyethylene or some other plastic material to serve as a support for oyster shells, other set collectors, seed oysters, or spawners. Some plastics are neutral, virtually indestructible materials which last many years. Polyethylene has been used for years in experiments and has been found extremely durable. It is inexpensive—

sheets costing less than ten U.S. cents per square meter if purchased in large quantities. In the spring of 1958 an experiment was undertaken on the mud flats in Milford Harbor, U.S.A. where a polyethylene sheet (6 mils thick and 6.6 meters wide) was spread on the bottom in such a manner that half of it was above and half below the mean low-water mark. Soon after that, large quantities of oyster shells, loose and in special chicken-wire bags, were placed on the polyethylene. An extremely heavy set of oysters occurred on the shells resting on the plastic. This was also true for nearby areas, where oyster shells were resting directly on the bottom because of the unusually heavy oyster set that occurred that year in Long Island Sound and its tributaries. However, heavy setting on the shells placed directly on the plastic corroborated earlier laboratory observations showing the lack of adverse effects of polyethylene on oyster larvae and set. Continued observations indicated that the polyethylene sheet withstood seasonal changes very well and that even the severe winter of 1958/59, when the tidal flats froze frequently and large quantities of ice were formed in Milford Harbor, did not noticeably affect the plastic which showed no signs of deterioration and continued to support the heavy load of shells and oysters.

In addition to converting soft bottoms into usable ones, polyethylene sheeting can be used for still another purpose. For example, recent literature contains several remarks made by oyster biologists, especially the Japanese, concerning a gradual deterioration of food oyster bottoms after being used for some time. They ascribe this to the accumulation of molluscan waste products which gradually decompose, rendering the bottom toxic to oysters. Such areas could probably be restored to their former productivity by covering them with polyethylene sheeting or similar material, which would isolate oysters from the deleterious effects of polluted bottoms. Still other uses of polyethylene sheeting suggest themselves. One, perhaps, is that of creating favorable conditions in specially-designed ponds and tanks for the cultivation of commercial species of sponges. The material can also be used for protecting the bottoms of oyster dikes and claires (small enclosed oyster ponds) from burrowing crustaceans, such as members of the genus *Upogebia*, and also for retaining the water in claires built in areas where the natural soil is too porous. (*Comm. Fish. Rev.* Nov. 1959).

Largest Netherlands Trawler

A trawler which will be the largest of the Netherlands fishing fleet is being constructed according to a new design based on conclusions of the FAO 2nd International Fishing Boat Congress held in Rome in April last which dealt with requirements to be met by a modern trawler. The dimensions are: length 51.9 m., beam 8.7 m. and molded depth 4.5 m. The vessel, which will be propelled by a 1,200 h.p. engine, is a self-fishing factory vessel to be provided with a deep-freeze hold. The vessel will be capable of fishing in all fishing grounds, including those in Iceland, Greenland and Newfoundland. (*Netherlands Economic Bulletin*, Vol. 11, No. 1, 1960).

Electronic Harpoon

A new electronic harpoon, which is a modified version of the one originally developed by a West German fisheries scientist, has been recently demonstrated

aboard a swordfish catching boat off the Nova Scotia, Canada coast. Using the new harpoon it was shown that in eleven hours of fishing at the height of the season, thirteen swordfish were sighted, all the thirteen were killed out of which eleven were landed. The two escapes were said to be the result of faulty barbs. The electronic harpoon uses a 250 volt charge which is carried by cable (replacing the former rope) to the spear-head. The shock instantly kills the swordfish which means that it can be landed in the matter of a few minutes as compared with the average of 30 minutes to three hours to land the fish using the old technique. It is also reported that killing by shock leaves the flesh of the fish in better condition than if caught after a wild struggle. (*Canadian Fisherman*, Nov. 1959).

Freshness of Fish

A method for determining the freshness of sea fish based on the determination of volatile permanganate-reducing substances in fish, is stated to be independent of the variety of fish and easily done on whole fish, and fresh or frozen fillets. Air is passed through 5 ml. of test fish pulp, through a safety trap, and into an absorption flask containing either 10 or 20 ml. of 0.02N KMn04 in 1N NaOH. A 2 ml. aliquot, to which has been added 1 ml. 6N H_2SO_4 and 0.6 ml. 20 percent KI in 0.1N Na_2CO_3 is titrated with 0.00025N $Na_2S_2O_3$ to a starch indicator end point. The following microequivalents were found: 0 in freshly killed fish, 0 to 10 in fresh fish, 10 to 20 for those with first observable changes in quality, greater than 20 for those starting decomposition, and greater than 30 for those showing putrefaction. (*Comm. Fish. Rev.*, Dec. 1959).

Meal from Fish Viscera

In its continuing search for more ways to utilize the waste products of fish, the Fisheries Research Board of Canada, at its Technological Station at Halifax, N. S., has produced visceral meal as an additive to livestock feeds. Unlike fish meal—already used to supplement poultry and livestock ration—which is made from the discarded portion of filleted fish (chiefly the backbone and the head), visceral meal is made from the entrails of fish, with the exception of the liver, which is more valuable for other purposes. Visceral meal is a highly proteinized product, which contains all the essential amino acids plus the vitamins necessary for good nutrition. In its present state of development visceral meal would not be considered suitable for human consumption. However, a simple process of refinement could place it in the field of additives to human diet. Roughly, viscera represent about 15 percent of the total weight of the fish. It is these viscera—minus the liver—that fisheries scientists have utilized through a novel process. The operation is simple. The viscera are placed in a tank in their raw state and a preservative is added to inhibit bacterial decomposition. The preservative does not interfere with the natural digestive processes carried on by the enzymes in the viscera or intestinal tract. Through the process of digestion the viscera are broken down by the enzymes and transformed into a liquid. This liquid is dried on a drum drier to leave a rather coarse powder, dark-cream in colour. The powder contains original vitamins of the viscera and the proteins in a pre-digested form. Visceral meal has no taste of fish. Its flavour, rather, is not unlike that of bouillon. Even in present unrefined state, the addition

of salt, spices, etc., could make it into a palatable synthetic soup concentrate. The potential of visceral meal as a good additive for animals can best be seen in the light of the annual fish landings, say, of Canadian off-shore trawlers, which amount to about 3½ million pounds of round fish. From that total amount about 60,000 pounds of viscera is discarded at sea. If this otherwise wasted material could be processed it would represent about 60 tons of visceral meal. (*Trade News*, Dec. 1959).

Fish Oil Resin

Experiments conducted in Japan have shown that chlorination of fish oil results in the formation of a resin-like substance which seems to be a promising main ingredient of coatings such as varnish. Fish oil, which is previously treated with alkali to remove free fatty acids, is dissolved in carbon tetrachloride and chlorine gas is bubbled through it. The resulting product is a white, odorless powder, soluble in most organic solvents except in lower alcohols and ligroin. The product is stable and a solution in toluene is transparent, slightly yellow and forms a glossy, waterproof film. The film is durable and not corrosive to iron, copper, and aluminum. (*Comm. Fish. Rev.*, Dec. 1959).

Algae as Human Food

Studies conducted on algae since 1949 have disclosed that cultures of *Chlorella* could produce food at a rapid rate when given optimal conditions of culture medium, carbon dioxide, and sunlight. The efficiency of this tiny algal plant is indicated by a measure of food production called the degree of reduction. This is based upon the photosynthesis ability of the plant (1) to endothermically reduce CO_2 and H_2O and (2) to liberate O_2 and store energy. In this ability, *Chlorella* rates higher than do corn leaves, sunflower, or sugar maple wood. By analysis, *Chlorella* contains admirable quantities of protein (up to 58 percent) as well as carbohydrates and fat. *Chlorella* also has the ability to undergo constant mutation in response to environmental manipulations. This has permitted the development of strains capable of producing large quantities of protein. Mathematical extrapolation from laboratory yields indicates that 1 acre of *Chlorella* culture medium could produce about 40 tons of dried high-protein food per year. However, the problems of sterility, quality control, and processing would be costly and difficult. Since 1954, a group of Japanese scientists has been conducting extensive studies on *Chlorella* as a source of food. This group demonstrated that the addition of dried *Chlorella* powders to bread, ice cream, noodles, and similar staples increased their content of protein, vitamin A and ascorbic acid and yielded foods that had an agreeable taste and a greenish color that was not unpleasant. In the Annual Report of the National Institute of Nutrition, Toyamacho, Tokyo, Japan (1958), two groups of scientists published reports on studies of algae. The first group, E. Tamura et al., found that *Chlorella* and *Scenedesmus* were rich in protein, contained adequate amounts of the essential amino acids except methionine, and provided an abundance of vitamin A. These workers also found that the dried powder was digested incompletely and accepted poorly, owing to its odor, flavor, and color. Decolorizing the dried algae with methyl alcohol not only reduced the odor and color but

also improved its digestibility. Weanling rats fed dried *Chlorella* or *Scenedesmus* grew poorly as compared with similar rats fed casein. Decolorization of the algae improved the growth of the rats, but the product continued to be inferior to casein. The addition of methionine improved the nutritional value of the dried *Chlorella* enough to support optimal growth. The second group, H. Hayami and K. Shino, reporting in the same publication, described the effects of feeding a diet containing 19 percent decolorized *Chlorella* to young white rats. Growth responses were: casein 95.5 g., decolorized *Chlorella* 84.8 g., and dried *Chlorella* 66.6 g. These same workers also investigated the rate of absorption of decolorized *Chlorella* in five men. They found that much of the objectionable taste and odor of *Chlorella* was removed by decolorization but that the remaining smell and taste of the decolorized *Chlorella* were intolerable. The five men were given a basal diet containing 2,300 calories and 60 g. of protein per day. Three days later, in addition to their basal diet, they were given 30 g. of decolorized *Chlorella* (21 grams of protein). In the final 3-day period, they were given the basal diet and 100 g. of beef. The true digestibility of the three dietary regimes was calculated to be: basal diet 82.9 percent, decolorized *Chlorella* 83.0 percent, and beef 87.7 percent. From these and previous studies, it is concluded that algae do have nutritive value that can be applied to human nutrition. (*Comm. Fish. Abst.*, Dec. 1959).

Ivory of the Ocean

A small factory for making souvenirs from whale teeth was founded in 1957, at Sandefjord, Norway, one of the foremost whaling centers in the world, with the aim of providing work for disabled persons. This is the only place in the world that uses whale teeth. Until 1957, whale teeth were thrown away, because nothing could be done with them. Of all the tooth-whales, the biggest specimen is the sperm-whale (cachalot), caught in the Antarctic and in tropical waters. This whale possesses from 20 to 25 teeth on each side of its mouth. Nobody ever thought until recently of using the big cachalot-teeth, not even as a substitute for ivory. The whale factories provide the souvenir factory with the whale teeth, without any payment. At present, sixteen disabled persons work at this factory the annual production being about 8,000 objects carved from 10,000 whale teeth. These souvenirs—penguins, snow owls, polar bears, grouse, eskimo, Vikings, boats, corkscrews, ashtrays, pipe holders, candle holders, flag holders, ear-rings—go to gift shops in Norway, Sweden, Denmark, Germany and the U.S.A. This new industry is not run on a profit making or commercial basis. The "ivory of the ocean" serves no other purpose but to provide work and regular income for as many disabled persons as posible. (*World Veteran*, Oct. 1959).

NEWS FROM MEMBER GOVERNMENTS

AUSTRALIA

Fisheries Conservation

The Australian Government has taken action to protect spiny lobster (crayfish), an important dollar-earning export, and shark in extraterritorial waters. These are already protected in territorial waters by State legislation. The essential purpose of the new regulations is to conserve existing stocks. The regulations apply to Australian nationals only; no other nationals at present take spiny lobster or shark off Australia. The new regulations took effect from 1 August 1959.

Spiny Lobster: Australia exports about US$5 million worth of spiny lobster tails to the U.S.A. annually and it is hoped that the conservation measures undertaken will keep the catch stable. There is no hope of an increase in supplies from presently-known grounds, although a survey of the islands western of the Great Australian Bight may reveal new crayfish grounds. The Commonwealth Government, under legislation passed in 1959, is able to provide in extraterritorial waters the same protection for female spiny lobster already provided by State legislation in territorial waters. A closed season for female spiny lobster has been established and the taking of berried ones has been prohibited.

School Shark. Australia's third most important fish (in terms of quantity caught) is shark, and is principally sold by "fish and chips" shops. The school shark is a particularly important source of fish for the Victoria market. The latest proclamations by the Minister for Primary Industry have established a legal minimum length of 91 cm. (36 in.) and a closed season during November in extraterritorial waters.

The conservation measures in the form of notices issued under the Commonwealth Fisheries Act prohibits the taking in all proclaimed waters of female spiny lobster of any species having eggs or spawn attached, which means that the protection given to berried spiny lobster by the various States in territorial waters has now been extended to extraterritorial waters. A closed season is provided for females of the species *Jasus lalandii* from 1 August to 30 November in proclaimed waters off Victoria and Tasmania. This closed season would be extended next year to cover the period 1 June to 30 November to coincide with the closed season in Victorian and Tasmanian territorial waters. New notices have been published covering: (1) a legal minimum length of 91 cm. (36 in.) for school shark; (2) a closed season during November for school shark both in extraterritorial waters off New South Wales, Victoria, South Australia, and Tasmania; (3) a legal minimum length of 7 cm. ($2\frac{3}{4}$ in.) on the carapace for the spiny lobster *Panulirus longipes* in extraterritorial waters off Western Australia; (4) a closed season from September 1 to November 14 for the spiny lobster *Panulirus longipes* in extraterritorial waters in Western Australia between 30°S. latitude and 30°S. latitude. A

notice has also been included to provide a separate closed season from 15 December to 31 January for southern spiny lobster in the King Island area and the notice providing for a closed season in the whole Victorial Tasmanian area from 1 September to 15 October has been amended accordingly.

The notice covering a legal minimum of 10.7 cm. ($4\frac{1}{4}$ in.) on the carapace for southern spiny lobster in extraterritorial waters off Victoria and Tasmania has also been amended at the request of the Tasmanian Government to include prohibition of the cutting up or dismembering of spiny lobster on a boat.

The tenth notice, setting a closed season for the spiny lobster *Panulirus longipes* from 16 August to 14 March in the Abrolhos area, provides for a slight extension of the area to include the Turtle Dove Shoals.

Longline for Deep-Water Fish

The CSIRO has announced the perfection of a new method of catching deep-water "trevally" (genus Caranx), a fish which weighs 7 to 18 kg. (15 to 40 lb.). Trevally are caught off the continental shelf at depths of more than 183 m. (100 fm.). After years of experimentation, CSIRO had perfected a method which involves attaching 25 hooks, spaced a 1.83 m. (1 fm.) apart and baited with tuna or barracuda, along a line weighted down with a 32 kg. (70 lb.) weight. (*Comm. Fish. Rev.*, Nov. 1959).

Australian Fisheries Council

The annual Conference of Commonwealth and State fisheries officers which was held in Hobart, Tasmania in December 1959, made unanimous recommendation for the establishment of an Australian Fisheries Council on the same lines as the Australian Agricultural Council. The Hobart Conference was attended by representatives of the Fisheries Departments of New South Wales, Victoria, South Australia, Western Australia and Tasmania, and by representatives of the Commonwealth Fisheries Division and the CSIRO Division of Fisheries and Oceanography. Important recommendations passed by the Conference cover the setting up of a Special Loan Fund of £100,000 from the Fisheries Development Trust Account for loans to fishermen to improve craft and equipment. State fisheries authorities would investigate applications for such loans. Particular attention was paid to problems of conservation and exploitation of trawled fish in which case the States concerned should introduce 8.8. cm. ($3\frac{1}{2}$ in.) minimum mesh for all parts of ottertrawls and 8.2 cm. ($3\frac{1}{4}$ in.) minimum mesh for all parts of Danish seines with an exemption in Victoria to cover the whiting season. Revised regulations in respect of crayfish (Spiny lobster) would cover an improved and uniform method of measuring these shellfish to achieve greater accuracy and to prevent breaking off of the rostra. The Council also recommended that school shark regulations should be amended to include gummy shark on the request of Victoria and Tasmania. The Conference also recommended that the handbook, Australian Fisheries which was published for the second meeting of the Indo-Pacific Fisheries Council held in Australia in 1950 and is now out of print should be revised and republished. Also that the Munro "Handbook of Australian Fishes" should be published in book form after publication in *Fisheries Newsletter* has been completed. (*Fisheries Newsletter*, Jan. 1960).

New Research Vessel

Australia's new fisheries research vessel THYRSITES costing £12,000 will be used by CSIRO for its barracouta research program. F.R.V. THYRSITES is 42 ft. × 13½ ft. with a hull of $\frac{3}{16}$ inch mild steel plating, arc-welded. She is powered by a 5LW Gardner Diesel which gives her a speed of 8 knots. Auxiliary engine is a 4¼ h.p. air-cooled Lister. A 300-watt generator supplies electricity at 24 volts. She has two fuel tanks, each holding 200 gal., which give her a range of 1,900 miles, and her fresh water tank holds 200 gallons.

Equipment includes Fischlupe echo-sounder with Minilodar remote control of the transducer, transceiver, thermograph, etc. There are two bunks in the forecastle, two bunks and two settees amidships, galley with refrigerator, and toilet. (*Fisheries Newsletter*, Dec. 1959).

Fisheries of Queensland

The estimated production of edible fish for the Queensland for 1958-59 was 4,089 tons with a gross value of £644,888. Figures for the previous year were 3,715 tons valued at £700,721. Good mullet and mackerel seasons were mainly responsible for the increase in this year's production. Mullet again formed the greatest proportion of total receivals representing 48.3 percent as against 44.2 percent in the previous year.

The mackerel season at northern ports during the months of October to December was most successful and mackerel represented 12.8 percent of total receivals for the year as against 11.9 percent in 1957-58.

The production of crabs in 1958-59 totalled 507,583 bodies having a gross value of £48,526. These figures include 392,832 sand crabs with a value of £27,096. The figures for the previous year were 527,131 bodies valued at £51,070.

Prawns

The total production for the State was 3,500,000 lb. worth £450,000. The increase in total production despite the poor off-shore yield was due to heavy supplies from Moreton Bay during the earlier part of the year, and an increase in the number of prawning vessels.

In March a number of different minimum lengths for various species of prawns were set in place of the general limit of 3 inches for all species which applied previously. These lengths were based on the different sizes to which the various species grow.

Oysters

The estimated production of marketable oysters was 2,716 sacks valued at £25,689. In the previous year 979 sacks were marketed which realised £7,900. These figures reveal an increase of 1,737 sacks in production and £17,789 in value.

Pearl-Shell and Trochus

Production of both pearl-shell and trochus in the 1958 season (year ended 31st January, 1959) was considerably lower than in the previous season, 397 tons of pearl-shell being taken compared with 505 tons in the 1957 season, the respective figures for trochus being 396 tons and 539 tons.

Prices, too, showed a substantial decline, the average for pearl-shell being £392 per ton (£506 in 1957) and, for trochus, £260 per ton (£335 in 1957).

The decline in production was due, in the main, to the fact that fewer boats

operated following a drop in prices, and a poor demand except for quality shell. In the 1959 season there has been a better market for good quality shell, and the demand for lower grades improved. (*Department of Harbours and Marine Report*, 1958-59).

Fisheries of New South Wales

An Inland Angling License costing one Australian pound per year has been introduced by the New South Wales State Government and these license fees go into a special fund to be used for research, development, management and protection of the inland fisheries. The number of licenses issued exceed 50,000. This revenue has enabled the expansion of research activities considerably. A research station with modern laboratory facilities, darkroom, library, offices, stores as well as 27 ponds of various shapes and sizes and costing A. £75,000 is being constructed. The program of research envisages a study of the behaviour and biology of the native species of fish, studies on fish farming and fisheries management. It is hoped to make research facilities available to visiting scientists and provide training facilities for students.

AUSTRALIA: PAPUA AND NEW GUINEA

Fisheries development in these territories is proceeding as a result of considerable stimulation and enthusiasm provided by the Administration. The freshwaters of New Guinea and Papua do not provide a great quantity of edible fish and the introduction of *Tilapia mossambica* into some of the lowland areas and in suitable parts of the highlands has resulted in a marked increase in production. An important development following the introduction of *Tilapia* is that increased numbers of better quality fish, bream (*Sparus*) and estuary perch (*Lates*) are now entering the swamps and are available for the local fishermen.

Production of *Tilapia* in the Highlands plateau at an altitude of 5,500 ft. has not been too successful, possibly due to the low temperatures, of about 15°C., which prevail from time to time in these areas. Under proper management condition, however, fair harvests may be obtained and from one well fertilized pond of one acre in extent, 4 tons of fish were obtained on harvesting 18 months after stocking.

Experience in Papua and New Guinea appears to show that in well managed ponds, *Tilapia* can effectively control mosquito infestation and appears to be more effective than *Gambusia*.

Osphronemus gouramy and *Trichogaster pectoralis* were introduced in 1958 but have not spawned. It is anticipated that fingerlings of common carp recently received may show better adaptability to the upland waters.

Fishing in the estuaries yields valuable catches of mullet, estuary perch, jewfish, threadfin and milk fish, although the fishing is very often limited to feeding or spawning runs related to the wet and dry seasons.

The Administration is taking steps to introduce machine-made nets and twines to meet the demands of the growing cash economy within the terri-

tories and the imported materials are replacing the handmade fibres, twines and nets previously used.

Fisheries Research Vessel

A 60-foot vessel, the F.R.V. TAGULA, equipped for carrying out a wide range of fishing activities, oparates in Papua. It is well equipped for trolling using the Queensland fishermen's methods, oceanic longline fishing and small mesh trawling and is equipped to carry out a small amount of scientific research. A 30-foot vessel is used for inshore work near Port Moresby, and experiments are continuing using outboard motors in sheltered waters. Several different types of small craft, in addition to double canoes, are being tested. Although trolling for tuna and mackerel has been successfully carried out for centuries, the introduction of good lines with wire traces has greatly improved catches. The use of garfish (*Hemirhampus dussumierii*) for bait, as used by Queensland fishermen, has also given excellent results in fishing the mackerel runs. In work carried out by the F.R.V. TAGULA, most satisfactory results have bean obtained east of Samarai, where many catches exceeding 500 pounds per day have been obtained, while enough exceeded 1,000 pounds a day to warrant this method being adopted in commercial fishing. Considerable information on the Spanish mackerel migrations has been collected, and many important grounds for this species are now known. Greatest aid has been the use of echo-sounding equipment to locate reefs on dull and rainy days. In hand-lining, a large proportion of the catch is of poor quality snapper (*Lutjanus waigiensis*), called red bass. Best results are obtained at night, usually on reefs some distance from sheltered anchorages, and navigational difficulties limit reef fishing to irregular intervals. Small motor boats and canoes, however, often bring in quantities of government bream (*L. sebae*) and Malabar snapper (*L. malabaricus*) from 35-fathom reefs. Deep vertical lines fishing at depths of 75 fathoms in Rabaul Harbour are yielding considerable numbers of a large red fish (*Aprion ?*) up to 15 pounds in weight. This is not a first-quality fish, but it is meeting a considerable demand for fresh fish in the area (it is, however, not satisfactory in the "raw fish" dishes favoured by Chinese). experiments are continuing using horizontal lines on the bottom. A fourth method of fishing using horizontal longlines in the open sea is being tested. Garfish, fish strips, squid, mullet and silver biddies (*Gerres argyreus*) for bait have not yet given conclusive results. A variety of fish, including yellowfin tuna, ocean mackerel, sail fish, sharks and dolfins have been caught. However, using only five miles of longline has not proved economic because of the distances to be steamed to the fishing grounds—the 1,000 fathom line—and the wait between shooting and hauling to make an effective catch. Garfish produced the best results east of Normanby Island and in the area south of Jomard Entrance to south of Suau. No fish were caught using squid (caught on beaches) south of Hood Point, although yellowfin tuna offshore feed largely on an oceanic squid. Yellowfin less than 20 pounds are often taken on troll lines close inshore. The yellowfin taken by longlining ranged from 60 to 140 pounds.

Fish Preservation

The traditional method of preserving fish by smoking permits the fish be transported up to 50 miles from the fish-

ing grounds is being developed by the introduction of improved types of smokehouse and instruction on preparation of the fish prior to smoking.

One small refrigerator has been installed by the Fisheries Division but the results obtained do not warrant the installation of large capacity. Much will depend on the rate of increase in production particularly from the coastal waters before further plans for increased refrigeration are drafted. (*SPC Quarterly Bulletin*, Oct. 1959).

CAMBODIA

The Monthly Bulletin of Statistics issued by the Planning Ministry of the Royal Combodian Government for the period November-December 1959 shows that the export of fresh and dried fish from Cambodia declined from 5,203 metric tons valued at Riels 28,121,000 during the period October 1957 to September 1958 to 4,436 metric tons valued at Riels 20,555,000 during the period October 1958 to September 1959, a decline of 14.7% in quantity and 26.9% in value.

In 1958, 7 metric tons of fish fats and oils valued at Riels 68,000 were exported, there was no export of these products during 1959.

CEYLON

U.S.S.R. Aid

The U.S.S.R. has offered Ceylon a plan for economic and in development of Ceylon fisheries but on more advantageous conditions than those offered by Japan. The Japanese Government some time ago decided to give economic aid for the development of Coylon's fishing industry through a $4 million deferred payment loan from the Export-Import Bank. Now it is reported that the U.S.S.R. is approaching Ceylonese authorities with a similar plan but involving a loan of $30 million to be repaid over a 12-year period with interest at 2.5 percent. (*Comm. Fish. Rev.*, Nov. 1959).

The Extension Service Newsletter No. 18 dated 15 December 1959 gives the following information:

Fishing Boat Mechanization

The total number of mechanized fishing craft in Ceylon is now 231 and loans to permit the mechanization of 35 vessels have been granted to some of the 63 Fishermen Cooperative Societies which have expressed their intention of developing mechanized fisheries.

A new Fishermen's Cooperative Society is being organized at Beruwala, a large fishing center 34 miles south from Colombo. This center has a small natural harbour providing safe anchorage but until recently little interest in mechanization has been shown. Recently, introduction of 8 mechanized fishing crafts by progressive fishermen at this center has stimulated considerable enthusiasm and approaches have been made to the Government to obtain finance for further mechanization projects.

The Extension Service Newsletter No. 19 dated 15 February 1960 gives the following information:

Mechanization

Under the new scheme of granting leans for mechanized boats, 33 boats were put into operation by societies up to end of January 1960. 127 mechanized boats were put into operation by individual fishermen up to end of January 1960. The total number of mechanized boats now in operation, financed by Government loans as well as by other sources is 280.

Tuna Fisheries in Ceylon

There are at least six species of tuna in Ceylon Seas. Only one of them, the skipjack ("balaya") constitutes a distinct fishery while the remaining species are taken with other types of fish in seasonal operations using many types of fishing lines and nets. The skipjack fishery is pursued vigorously off the south and west coasts from sailing outrigger canoes ("oru"). Fishermen carry live bait in wicker baskets which are tied to the side of the canoe so as to keep their contents flushed with sea water as the canoe speeds along to the fishing grounds. Redbait "hingura" is the preferred bait fish, obtained from bays and other shallow coastal areas using cast nets. When a school of skipjack is sighted, the canoe is steered into it and each man on board begins to fish with pole and line. At first bait-fish are attached to the hook for attacting the skipjack to bite; live bait are thrown into the school for keeping it around the canoe and to cause sufficient excitement among skipjack to bite unbaited hooks lowered to them. Angling is continued till either the canoe is filled with the catch or the school moves out of range.

Beach seines ("madal", "karavalai") which account for about 40 percent of Ceylon's fish production, encircle at times vast schools of Mackerel tuna ("atavalla") and frigate mackerel ("raguduva"). Fishing centers on the north-west coast, chiefly those between Udappu and Marawila, are reputed to gather large yields, the fishermen there referring to both tuna species as "balaii". Another area of importance for "balaii" landings is Trincomalee - Batticaloa. Success in obtaining a few large hauls of several thousands of these tuna enables the net owner not only to meet the entire season's operational costs but also to realise substantial profits. The profits will sometimes be large enough to help him to risk any losses during the next season on this relatively inefficient gear, limited as it is to fishing in coastal waters only.

Yellowfin tuna ("kelavalla") are obtained by trolling from sailing canoes. About three or four fishing lines are trailed behind as the canoe moves at speed. The hook baited with either a silver-coloured fish or an artificial lure, is joined to the end of the cotton line by a short length of wire. The fast-swimming tuna are attracted to bite the spinning bait, glistening in the brightly lit upper layers of the sea, (trolling is always done by day). Large yellowfin tuna, sometimes weighing as much as 80 lb. are captured with this gear by fishermen operating off the south-west coast (Negombo to Hambantota). Other kinds of fish taken on this gear are large sharks, spearfish ("koppara"), sailfish ("thalapatha"), sier and dolphin fish ("vannava").

Handline fishing is another method used for catching large tuna from outrigger canoes. On reaching the fishing grounds in deep water just outside the continental shelf of the south coast, three or four fishermen on board roll down the sail and lower hand lines from the slowly drifting canoe. Each handline is quite

long and both ends carry large hooks baited preferably with squid. The ends are paid out from the opposite sides of the canoe to hang down at different depths and the entire line is controlled by one fishermen. Yellowfin weighing as much as 200 lb. each are reported among captures; more frequently these lines take large sharks.

Fishing with drift long lines was developed by the Japanese before World War II when exploring the Pacific and Indian Oceans for albacore and yellowfin tuna. They detected abundant resources of yellowfin in tropical seas especially near the Equator but at lower levels as large tuna tended to avoid the brightly illuminated surface layers by day. The use of long lines is being encouraged by the Department of Fisheries within its scheme of training local fishermen. This gear seeks to gather the deeper swimming tuna while the established trolling and pole-and-line fishing methods are designed for capture of those swimming near the sea surface. Baited hooks on short lengths of fishing line (branch lines) are fastened at intervals to a very long line which is lowered to a predetermined depth in the ocean by suspending it from floats. The entire gear is allowed to drift for a few hours in the currents before it is hauled back into the boat. Depths of 100 ft. to 350 ft. below surface may be fished and the catch includes, besides tuna, spearfishes, swordfish ("kodukoppara") and large sharks. Results of longline fishing from mechanized boats in off shore waters around Ceylon are good and this method is growing in popularity among local fishermen.

Ceylon's production of tuna in 1957 amounted to nearly 3,500 tons which formed 9.5 percent of total fish landings from our waters. In the Maldive Islands, a group of atolls situated about 450 miles to west of Ceylon, the major industry is the preparation of the cured tuna product, maldive fish. This is derived from a large skipjack fishery using live bait with pole and line from sailing boats, a method essentially similar to the one used in Ceylon waters. About 3,000 tons of Maldive fish are imported into Ceylon from there each year.

Nylon Nets

During the last year the use of nylon nets for fishing has increased considerably. Cotton nets are being gradually replaced by nylon nets. Nylon nets are mainly used by the *teppam* and *kattumaram* (log raft) fishermen. The largest number of nylon nets are used in the Negombo, Mannar and Kankesanturai areas. It is estimated that about ten thousand nylon nets are now in use.

FRANCE: FRENCH POLYNESIA

The taking of pearl shell in this area is strictly controlled. No bed may be fished more than once in every 4 years and the minimum size of shells which may be taken is specified according to the lagoons in which the fishery occurs. Protected areas are defined in these lagoons to ensure an adequate supply of spat for the next fishing season. Diving for the pearl shell is undertaken by the local fishermen who operate in depths of up to 24 fathoms from small

canoes fitted with outriggers. Some of these vessels are powered by outboard engines or are towed to the fishing grounds by small powered craft. Rigid control is exercised over the use of diving equipment, particularly aqualungs, but the majority of the divers do not use these aids. (*SPC Quarterly Bulletin*, Oct. 1959).

INDIA

Small Model Fish Meal Plant Developed

A demonstration of a small model fish meal plant, developed by a fisheries engineer, was held late in June 1959 at a fisheries plant in Bandra, Bombay, India. The plant was designed and built by the fisheries engineer with the help of an expert on boilers, for the manufacture of fish meal from nonfood fish and fish waste. The demonstration was attended by the Bombay Director of Fisheries, members of the Bombay Fish Meal Exporters' Association, Japanese fisheries experts, and local fishermen. Fish meal is exported and is a source of considerable foreign exchange to India. Fish meal has been manufactured locally by sun-drying the fish on concrete floors, which is a laborious process, requiring some two to three days to complete the process, depending on weather conditions. In addition, the final product contained a large amount of sand, and the protein content was never higher than 50 percent.

This fish meal plant is the first of its kind in India and is built entirely to suit local conditions. It requires no power and it consists of a double-jacketed dryer, a superheater, boiler and furnace, all built as one compact unit. The uniqe feature of this plant is that it can be operated on any fuel available, hence suitable for any part of the country, even when installed on fishing boats. The cost of operation is as low as Rs. 15 (about US$3.15) per ton of fresh fish, and requires only one man to operate it. It is so built that it does not come under the regular Boiler Act, hence, it needs no registration. Each unit can handle some 5,000 lb. of raw fish per 24 hours, and the unit is expected to cost about Rs. 6,000 (about US$1,270). (*Comm. Fish. Rev.*, Nov. 1959).

INDONESIA

Fisheries—a Major Industry

The Union of Indonesian Fisheries Cooperatives (GKPI) has announced that, according to data compiled by the Union, there are now about 400,000 fishermen in Indonesia. The fishermen operate 950 motor fishing vessels, and about 110,000 sailing craft of various size. (*Comm. Fish. Rev.*, Nov. 1959).

Fisheries Development Program

Recent information suggests that the total fish output for Indonesia was approximately 685,000 metric tons in 1958 which amount to approximately 2 kg. per person per annum. This quantity is far below the estimated requirement of 17 kg. per person and in order to increase production, a Special Fund of Rp. 11,318,000

is to be established in 1960. The program for development includes exploratory fishing by mechanized fishing craft, provision of motor transportation from landing points, research into the preservation of marine produce and the provision of facilities at landing points for the fishing vessels.

Some other projects, operating mainly under private enterprise, but in some cases with a subsidy from the Sea Fishery Cooperative Association and the Sea Fishery Organization Fund include some very large schemes for which current estimates of capital investment are as follows:

1. Sea Fishery Development Project of Indonesia ..... Rp. 45,000,000
2. Sea Fishery Institute ..... Rp. 27,583,300
3. Kota Baru Fishery Community Project in Kalimantan ..... Rp. 25,146,900
4. Bodjo Shipping Enterprise ..... Rp. 11,377,800
5. Cannery Project in Ambon ..... Rp. 5,750,000.

The Central Sea Fishery Service will supervise the development of these projects which are, however, to be separately financed and will not entail financial obligations on the Sea Fishery Service itself. (*Business News Analyses*, Dec. 1959).

JAPAN

Fishing Industry

As of August 1959 both large and medium-size Japanese fishery enterprises were enjoying an unexpected prosperity. Last year's Antarctic baleen whale oil sold on the average for export at 73,532 yen (US$ 204) per metric ton, while the price for domestic sales was 85,000 yen (US$ 236) for an over-all average of 74,258 yen (US$ 206) per ton. This year the export price was 71,997 yen (US$ 200) and the domestic price 78,000 yen (US$ 217) for an average of 72,778 yen (US$ 202). But this year storage costs were less, so the price for baleen oil can be considered about the same as last year's. For sperm oil last year's average export price was 64,389 yen (US$ 176) per ton and the domestic price was 75,000 yen (US$ 208) for an average of 67,554 yen (US$ 188) per ton. This year the over-all average sperm oil price was 57,000 yen (US$ 158), a considerable drop from last year. But whale meat has sold unexpectedly well, stocks are low, and the price is about 15 percent above last year's. Furthermore, this year's coastal whaling has been extremely good.

In the salmon fishery, despite the cut in the catch quota, total production is at about the same level as last year because of good fishing south of the Japan-Soviet treaty area. Mothership fleet operations took 30 days less than last year, the price of canned salmon is 12 percent higher than last year, and frozen and salted salmon, because of short supplies, are also about 10 percent higher than last year.

Tuna prices are not much different from last year's, but the East China Sea trawl fishery had a record catch of shrimp, and the prices of mackerel-like fishes were generally up. Sales of frozen

products and sausages continued strong and are expected to top last year by about 20 percent. All of these favorable factors combined have brought about a quiet boom in the fishing industry. (*Comm. Fish. Rev.*, Oct. 1959).

More Efficient Tuna Longliner

A Japanese shipyard has completed the design of a new type of tuna longliner that will carry over 10 percent more fish than previous types of the same size. Among the reasons why the shipyard undertook this study is the fact that, with the prospects of excess salmon fishermen coming into the tuna fisheries as a result of reorganization of the North Pacific fishery, the price per ton for tuna boat construction rights has risen very high. For this reason prospective builders are seeking designs that give a high carrying capacity in proportion to gross tonnage.

The design is for a 250-gross-ton vessel that is said to have a carrying capacity equal to a 300-ton vessel. Hitherto 250-ton boats have carried only 148 to 152 short tons, but the new design is expected to carry about 168 short tons. It will have a daily freezing capacity of 8 tons, as compared with the 3 tons usual on boats of this tonnage. (*Comm. Fish. Rev.*, Oct. 1959).

KOREA

Mr. Yong Joon Park of the Department of Marine Affairs, Pusan, Korea, has returned home after a 6-month fellowship to study improved fishing equipment and methods with a view to applying these under Korean conditions. He visited Italy, Iceland, Germany and Canada and spent a great proportion of his time on fishing craft operating modern fishing equipment in these countries.

FEDERATION OF MALAYA

Daily forecasts over Radio Malaya of weather conditions covering the North-East Monsoon months on the East Coast i.e. from November to February, were instituted in 1958-1959 and they have since proved to be of great benefit to fishermen on the East Coast. Many of the fishermen were enabled to fish in the fine days of the monsoon period, as a result of these broadcasts which give the speed of wind and the height of the swell anticipated.

NETHERLANDS: NEW GUINEA

Steady progress in fisheries development is reported from this territory. One inland and two sea fisheries stations have been established and the first of a fleet of motor fishing boat has been built and launched.

Five species of fish have been introduced: Carp (*Cyprinus carpio*), Giant gourami (*Osphronemus goramy*), Tilapia (*Tilapia mossambica*), Sepat Siam (*Trichogaster pectoralis*), Kissing gourami (*Helostoma temminckii*), and of these, carp and

Tilapia have spawned and distribution of fingerlings have begun.

The two marine stations have been established at Hollandia and Manokwari and from these stations, work on the mechanization of fishing craft and the construction of new types of vessels will be conducted. (*SPC Quarterly Bulletin*, Oct. 1959).

PHILIPPINES

Fisheries Research Vessel

The fisheries developmental work and research activities of the Bureau of Fisheries have been greatly enhanced by the arrival of the M/V MALASUGUI, a 110-ton research vessel from Japan through the Reparation Program. This boat is equiped with modern navigational instruments such as radar, direction finder, Sea Scanar fish finder, radio receiver, and radio transmitter; refrigeration units and other equipment needed in mechanized fishing operation of gear such as deep-sea trawl, tuna longline and bouki-ami; and scientific instruments for biological and oceanographic research purposes. The proposed activities of the boat include four phases, namely: survey, training, demonstration, and research. Unexploited waters of the Philippines will be surveyed. Local fishermen will be trained in the operation, construction and repair of fishing gear suitable for deep-sea fishing. The operation of tuna longline, deep-sea trawling, bouki-ami, demersal, surface, and mid-water trawls will be demonstrated in order to induce present-day trawl operators to go to deeper waters thus leaving the shallower areas for the small fishermen. Lastly, the monthly oceanographic and biological studies on fishing grounds, particularly Manila Bay, initiated in 1957, will be carried on.

Fish Imports

Despite the increase in fish production during the year 1958 by more than 39 million kilograms over that of 1957, statistics show that the importation of fish and fish products continued on an upward trend. Fish imports increased by about 9 million kilograms representing a value of over 4½ million pesos. This may be attributed to the fact that the demand for fish and fish products has increased tremendously.

In order that the fish requirements can be adequately met, the Bureau of Fisheries is implementing its program of increasing fish production by: (1) giving demonstrations of modern fishing methods to be applied to deep-sea fisheries which are still unexploited on a commercial scale; (2) encouraging the conversion of idle swamplands into productive fishponds and the practice of modern fishpond management and operation including fertilization; and (3) fish planting of lakes, rivers, and lagoons and other inland waters including dams and reservoirs.

FAO Expert

Mr. Tatsuzo Suzuki, FAO expert with the Bureau of Fisheries gave a lecture on profitable fishing methods at a fishermen's meeting held in Culasi, Roxas City, on 12 December 1959 under the

sponsorship of Caltex (Philippines) Inc. He stressed the efficiency of fishing methods from abroad which could be adopted in the Philippines. On the same occasion, the canning of bangos (*Chanos chanos*) was demonstrated by two fishery technicians from the Fisheries Research Division of the Bureau of Fisheries.

SOUTH PACIFIC

Tuna Investigations

The commercial possibilities of tuna fishing in waters around French territories are being tested by the research vessels of the French Institute of Oceania, Noumea and Pacific Oceanic Fisheries Investigations. From the combined data, it is now possible to draw practical conclusions of considerable importance for the eventual development of tuna fishing in the areas. Exploratory fishing undertaken by ORSOM III and the vessels operated under the aegis of POFI has been accompanied by intensive studies in oceanography and hydrology. The data thus obtained has been supplemented by reports received from Japanese fishing companies operating in the South Pacific region. Practical fishing trials with local longlines showed considerable promise and the results compared favourably with other regions. In the New Caledonia area in January and in May 1959, the maximum yield was 5 fish per 100 hooks with an average of 3 per 100. The average weight of the fish was 80 lbs.

As a result of the investigations so far conducted, it appears that around New Caledonia and Dependencies and around the Condominium of the New Hebrides, fishing for skipjack, yellow-fin and Spanish mackerel can be carried out on a small scale with trolling gear. Some of these and other species may be taken on a commercial basis with longlines. Around the islands of French Polynesia, tuna fishing with live bait is sound commercial practice.

The data so far collected emphasize the very great importance of the scientific research work carried out from the territories. Such results as are already available have indicated which are the best methods to be used according to the type of fishing intended, whether small scale or commercial and provide information concerning the species of fish and rate of yield, which will be of use for eventually commercial development. (*SPC Quarterly Bulletin*, Oct. 1959).

THAILAND

German Aid

In 1956 an agreement on economic and technical cooperation was concluded between the Kingdom of Thailand and the Federal Republic of Germany. Within the scope of this agreement the Federal Republic sent to Thailand a delegation and a number of experts from various special branches to assist the Thai authorities in an advisory capacity. In 1959 March a supplementary arrangement to the above

agreement was signed to establish a German-Thai Vocational School in which already for many months past students are receiving their technical training. On 27 January 1960 a second supplementary arrangement was signed. Therein, provision was made that the Federal Government assist to the utmost of its power the Thai Government in its efforts to develop the Thai fisheries, especially in the field of deep sea fishing, by sending experts and materials. Under this supplementary arrangement the Federal Government will provide several sets of fishing nets of various kinds and makes, and fish detection equipment. A German fishery expert will be sent to advise on planning the undertaking for a period of six weeks. Another specialist will be coming for a period of three months to instruct the Thais in modern fishing techniques. Moreover, an expert will be sent to supervise the installation and maintenance of the very sensitive electronic fish detection gears and to instruct the crews for some months. Finally a specialist in winches will be dispatched to supervise the installation and expert maintenance of the winches. All the nets, implements and other equipment will become the property of the Thai Government after completion of the experimental fishing. The German-Thai project will be put into practice with the cooperation of the Thai Government which will assume responsibility for part of the costs. The Thai Government will provide newly built fiishing vessels and pay the total costs for the German specialists during their stay in Thailand. It is hoped that the German-Thai experimental fishing will contribute substantially towards modernizing Thai fisheries.

Fish Marketing Seminar

On the 1st of February 1960 the Minister for Agriculture convened a Seminar on Fish Marketing Problems. The Seminar was attended by representatives of all professions and industries concerned with fisheries and fish marketing.

The subjects discussed at the Seminar included :

1. Problem of organising central fish markets;
2. Co-ordination of work between the Cold Storage Organization and the Fish Market Organization;
3. Supply of sea food to inhabitants of inland provinces;
4. Enquiry to determine the truth of the allegation that Thai freshwater fish are becoming scarce;
5. Preservation of fish for long-range consumption or for export purposes;
6. Examination of the question whether it is necessary for Thailand to import foreign fish.

On the basis of these discussions, the Ministry is taking under consideration a review of policy and is keeping in mind the possibility of revising existing fishery legislation in Thiland.

U.K.: NORTH BORNEO

Tuna Fisheries

In December 1959 the Government of the Colony of North Borneo approved an application from the Japanese Taiyo Fishing Co. to reinstitute tuna fishing on the northern and eastern coasts of the

Colony and to set up a processing plant on Si-Amil Island. A Japanese company had operated a tuna processing plant on this island before the Pacific War but the plant was completely destroyed and this is the first positive attempt to re-establish this industry. The tuna boat AZUMA MARU NO.5 carried out exploratory fishing in the vicinity of the Si-Amil island in December by the bait and pole method. The attempt was successful and the success apparently limited only by the shortage of bait which consisted of anchovies and small horse mackerel brought from Japan. The bait fish could not be acclimatized to the much higher temperature of the North Borneo waters and only a short period of fishing was possible. During the exploratory cruise, 4 schools of tuna were sighted but only one school took to the bait and the fishing went on for about 7 minutes during which approximately 300 fish weighing about 1,750 lb. were taken. The tuna caught were striped tuna or skipjack, approximately 95% of the catch, and some yellow fin tuna. The use of live bait was supplemented by the water spray pumped from jets disposed around the side and stern of the vessel.

Fisheries Development Plans

The Fisheries Branch of the Department of Agriculture, which was concerned only with freshwater fisheries, has now been made responsible for the development of sea fisheries with effect from 1960. To cope with this increased duty, four junior officers will be recruited, two of whom are to be trained in Hong Kong for six months in trawl fishing, navigation and seamanship, while the other two will be trained locally. Trawl fishing was started in 1958 in the Marudu Bay area and is now firmly established. Other methods of sea fishing which are not conventionally used by local fishermen, were introduced in late 1959. These methods are the Hong Kong type beam-trawling for prawns and live-bait pole-and-line fishing for tuna and bonito introduced in the East Coast waters; results have so far proved promising. The fisheries Branch is planning to build, for the purpose of demonstrating trawl fishing in shallow waters, two small trawlers (based on local boat design) which will be about 30 ft. in length and powered by a 30 HP diesel engines. These trawlers when completed will be chartered to selected fishermen and the trained officers from the Fisheries Branch will accompany them to supervise the use of trawling gear. The aim of the development of sea fisheries in North Borneo is twofold: (i) to ensure regular supplies of fish for local markets and (ii) to promote an export trade, especially in luxury items, such as prawns and tuna.

U.K.: HONG KONG

Credit Facilities

During the last quarter of 1959, loans totalling $132,920 were made from the Fish Marketing Organization loan fund to 97 members of fishermen's co-operative societies and 76 loans totalling some $49,100 were issued to individual fisherman. Repayments to the fund totalled nearly $171,150.

Fish Marketing Organization

On the whole, fishing conditions were good throughout the last quarter of 1959 period although strong winds

during December adversely affected the fishing operations of long liners and trawlers. Sales of fresh marine fish through the wholesale markets totalled over 204,000 piculs, being an increase of some 11% over the preceding quarter. Of this total, 179,185 piculs were landed by the local fleet, 22,752 piculs were imported from the China Mainland and only 2,063 piculs were landed by foreign fishing vessels operating under the quota system. For some considerable time this quota system has been a formality only and has virtually been inoperative: the monthly quota ceiling of 10,000 piculs has never been taken up fully; indeed the average monthly landings have only been in the region of 600 piculs. In the circumstances, it has been decided to raise these restrictions with effect from 1 February 1960.

Sales of salted dried marine fish increased to nearly 32,800 piculs. Of this total, over 60% was imported from Mainland China. A considerable quantity of these imports was found to be of such poor quality that it was sold as poultry feed and fertilizers. As a result of the increased landings, the price of fresh marine fish dropped from $65 a picul in July/September to $61 per picul this quarter. The decrease in salted dried marine fish prices from $45 per picul to $34 was mainly on account of the considerable quantities of poor quality fish marketed.

Education

The number of fishermen's children receiving education with the aid of Fish Marketing Organization at the end of the quarter totalled 2,259. Of this number, 1,363 were pupils at Fish Marketing Organization Schools.

U.S.A.: HAWAII

During the past summer, Dr. Albert L. Tester, Senior Professor of Zoology at the University of Hawaii, conducted research on the behavior of sharks at the Eniwetok Marine Biological Laboratory in the Marshall Islands. His work, supported by an Office of Naval Research Contract, is concerned with an analysis of factors affecting shark behavior, particularly those concerned with feeding activity. It is hoped that a basic study of these factors will suggest a new approach to the problem of protecting fishermen, skin divers and survivors of air and sea diasters from shark attack.

Laboratory work in specially constructed tanks involved a study of vision and olfaction in blacktip sharks. The parts played by these two senses in feeding were assessed, using normal, blinded and olfactory-occluded sharks. Special tests were conducted on the response of sharks to human blood and sweat.

Field work was conducted on grey, whitetip and blacktip sharks in the lagoon using both Scuba gear and special underwater observation chamber. Experiments included the response of sharks to living and dead prey and to extracts of food substances, thus providing a comparative study of feeding patterns in the three species.

The shark study is being continued this winter at the Hawaii Marine Laboratory where the responses of captive grey, tiger and hammerhead sharks to a variety of stimuli are being investigated. Next summer the research will continue at Eniwetok Atoll.

FAO ACTIVITIES

Resignations

Dr. G.L. Kesteven has resigned from his post as Chief, Biology Branch, Fisheries Division to return to Australia to take up the post Director of Fisheries Research in the CSIRO Division of Fisheries and Oceanography. Dr. Kesteven joined FAO in 1947 as Regional Fisheries Officer for Asia and Far East and was Chief of the Biology Branch at Rome since 1954. He was the first Secretary of the IPFC.

Appointments

Dr. A.W. Meschkat (West Germany) has been appointed FAO Regional Fisheries Officer for Africa, Dr. Meschkat took up his appointment, with headquarters at the FAO Regional Office for Africa at Accra, Ghana, on 15 January 1960. Dr. Meschkat's task will be to assits governments to develop fish production of the seas off East and West Africa and of the lakes and rivers of Central Africa. He will travel extensively in Central and Western Africa to assess the inland and marine fishery resources and to assist and advise governments in increasing production. A graduate of the University of Hamburg (Germany), Dr. Meschkat has held FAO fishery assignments in Yugoslavia in 1955, in Brazil from 1956-1958, and as FAO Regional Fisheries Officer for Southeast Latin America in 1959.

Mr. S.J. Holt, Chief, Research Programs Section, Biology Branch has succeeded Dr. G.L. Kesteven as the Chief, Biology Branch, Fisheries Division.

Staff Movements

Dr. Heen Chief, Technology Branch visited India, Ceylon, Thailand, Indonesia and the Philippines during November–December 1959. He held detailed discussions with the ETAP experts working in this area and reviewed the fisheries development with the Government Officials. He also had further discussions with the Government Officials at the Manila regarding the ETAP Training Center on Fish Processing to be held during 1961.

Mr. P. Lusyne Fishing Gear Technologist visited Vietnam, Hong Kong and Japan to obtain detailed information on various types of fishing gear, for inclusion in the Catalogue of Fishing Gear Designs, now in preparation.

Mr. N. Fujinami Naval Architect visited Chittagong and Khulna in East Pakistan where he advised the Government on the mechanization of fishing boats, and also examined the fishing boats and mechanized boats actually under construction.

Technical Assistance

The ETAP team of experts working in the Bay of Bengal at Visakhpatnam has now increased to three USSR experts, Mr. Naumov, fisheries biologist, Mr. Borisov, gear technologist, Mr. poliakov, master fishermen (trawling) and also a further USSR expert, Mr. S.B. Gulabadamov is based at Barrackpore, Calcutta, and is working on the development of fishing techniques in large impounded bodies of water. The curriculum vitae and work program of Mr. Borisov and Mr. Gulabadamov are as follows:

Mr. N.I. Borisov of the USSR has been appointed as a Fishery Technology Expert to the Government of India. Mr. Borisov's program of work is to carry

out experimental and exploratory deep-sea fishing (trawling) in the Bay of Bengal. He will work with the FAO/TA Biologist, Mr. Naumov, as a team in making a survey of deep-water fishing grounds along the continental shelf. Mr. Borisov is a Russian national, born in Odessa City, USSR, 9 April 1910. Since 1957 Mr. Borisov has been employed by the State Planning Committee, Moscow, as senior engineer in the Fishing Division. He has been responsible for carrying out plans and actions in the development of fish catching in USSR and for conducting scientific research and exploratory work in increasing fish production and introducing advanced methods in fishing techniques. From 1955 to 1957 Mr. Borisov was a fishery expert in the Korean People's Republic.

Mr. S.B. Gulbadamov of the USSR has taken up his duties as a fishery Technology Expert assigned to the Government of India. Mr. Gulbadamov's duties are to advise and assist the Government in the development of fishing techniques in large impounded bodies of water such as reservoirs where special problems such as submerged timber, topography, etc., make normal fishing operations difficult. Mr. Gulbadamov is a Russian National, born at the City of Mary, Turkmenian S.S.R., 8 August 1925. Since 1953 Mr. Gulbadamov has been employed at the Fisheries Research Institute of Moscow as senior scientific worker in the Department of Scientific Research. He has explored new methods of inland fisheries with the use of electric current, and has carried out experiments on developing gear constructions for fishing in land-locked reservoirs. He has also been engaged on a study of the trawl operation with the use of electric current in the Rybinski Reservoir, and has worked on the development of methods and techniques for the operation of gear used in big inland reservoirs, In his work, Mr. Gulbadamov will be assisted by Mr. G.A. Semin, a Russian national who will act as English Interpreter. For the past two years Mr, Semin has been employed at the Fisheries Research Institute of Moscow as Translator and Interpreter.

Fellowships

Mr. Pillai, Inland Fisheries Biologist, Ceylon, has been granted an FAO Fellowship for a period of 6 months for study in brackish water fish culture in the Philippines, Indonesia and Hong Kong.

The following ETAP Reports have been published:

India: No. 1096. Second Report to the Government of India on Fishing Gear and Methods. P. Gurtner.

No. 1167. Fish Marketing in Madras, Bombay and Mysore States. C. Gonzales.

Thailand: No. 1095. Report on the International Training Center on the Methodology and Techniques of Research on Mackerel. S.J. Holt.

No. 1164. Handing and processing of Fish. G. Sand.

IPFC AFFAIRS

Personnel

Mr. W.A. Dill, Chief, Inland Resources Section, Fisheries Biology Branch, has replaced Mr. S.J. Holt as the Technical Secretary, IPFC Technical Committee I.

Dr. Katsuzo Kuronuma, Chairman of the Council during its 8th Session held during 6-22 December 1958, at Colombo, Ceylon, who resigned his post of Chief, Freshwater Fisheries Research Laboratory, Hinomachi, Minamitamagun, Tokyo, Japan, is now with the U.S. Consultants Inc., 86-96 Duong Tu-Do, Saigon, Vietnam.

Circulars issued by the Secretary IPFC

1) Member Governments were advised of the budgetary restrictions and consequent impossibility of providing the usual English-French, French-English interpretation services at the 9th Session of the Council proposed to be held in the last quarter of this year at Karachi, Pakistan (?)

2) Member Governments have been informed of the replies received so far to the earlier circular of 2nd September 1959 concerning inter-session meetings of the IPFC Technical Committees and the Special Sub-Committees and also the results of discussions held with Government officials during the FAO Conference in November 1959. Certain suggestions have also been made concerning the subjects to be discussed at these meetings to elicit the opinion of the Member Governments.

3) The authors of technical papers read at the 8th Session held at Colombo, Ceylon, during 6-22 December 1958, have been requested to state the requirements of the reprints of the papers.

4) A list of FAO fisheries reports arising from the Expanded Technical Assistance Program has been sent.

5) Circular to certain Administrative Correspondents concerning the mailing list of Current Affairs Bulletin.

6) A circular concerning echo sounder and fish-finder manufactured by a British firm.

Activities of Technical Committees

Technical Secretary, Technical Committee II of Panels A and B issued a circular to members of Panel A enclosing the detailed report of the work of FAO Fishing Gear Technologist on the development of one-boat mid-water trawl.

Publications issued

(1) Occasional Paper 59/12 -
"Method used for separating and counting the eggs in fecundity studies on the plaice (*Pleuronectes platessa*) and herring (*Clupea harengus*) by A.C. Simpson

(2) Draft report on boiled fish in South East Asia and Far East.

PERSONALIA

Dr. Nazir Ahmad, Director of Fisheries, East Pakistan has been appointed Director of Fisheries, West Pakistan.

He is Chairman of the Fisheries Panel of the Food & Agriculture Commission set up by the Government of Pakistan recently. He has been a member

of the Technical Committee I of the Indo-Pacific Fisheries Council since 1950.

Mr. F.F. Anderson, Director of the Fisheries Division, Department of Primary Industry, Canberra, Australia retired from government service on 25 November 1959. Mr. Anderson was appointed Commonwealth Director of Fisheries in September 1946 following the establishement of the Fisheries Division of the former Department of Commerce and Agriculture. Prior to this appointment, Mr. Anderson has a long and meritorious service in both the State Government of Western Australia and with the Australian Commonwealth Government. He wasdeeply interested in fisheries development and particularly active as Australian Commissioner on the International Whaling Commission from 1949 onwards Prior to this date, Mr. Anderson was the Australian plenipotentiary to the International Whaling Convention held in Washington, U.S.A., in 1946. Under his administration, the Commonwealth Fisheries Division took active steps to develop and protect the whaling and pearl shell fisheries of Australia and cooperated very closely with the State Fisheries Department in developing those aspects of the Australian fisheries directly under State control. Mr. Anderson represented Australia at the United Nations Fisheries Technical Conference held in Rome in 1955 in preparation for the Geneva Conference on the Law of the Sea which he also attended in 1958. He was also a foundation member and has continued to serve on the Australian Antarctic Advisory Committee since its establishment in 1946. Mr. Anderson has always had a keen interest in the work of the Indo-Pacific Fisheries Council. He was alternate delegate at the 2nd Session held in Cronulla, Australia, and Australian delegate at the 5th Session held in Bangkok, Thailand. The Indo-Pacific Fisheries Council takes this opportunity of extending to Mr. Anderson its best wishes for a long and enjoyable retirement and expresses its appreciation for his active and enthusiastic interest in the management and development of the fisheries industry of Australia and the region in general.

Mr. C.G. Setter has been appionted Commonwealth Director of Fisheries, following the retirement of Mr. F.F. Anderson. November 1941, he joined the staff of CSIRO, Division of Food Preservation and Transport and worked on the production of vitamin oils and protein meals. During 1942, in collaboration with Dr, G.L. Kesteven, former Chief, Biology Branch, FAO Fisheries Division, he prepared a report on the fishing industry for the Manpower Directorate and Department of War Organization of Industry. In 1945, Mr. Setter represented the Australian Government at the International Whaling Conference in London, and in 1946 he was a delegate to the International Whaling Conference in London, and in 1946 he was a delegate to the International Whaling Conference in Washington, where the International Whaling Convention was signed. In 1958 he attended the annual meeting of the International Whaling Commission at the Hague as the Australian Commissioner. In 1952 he led the Australian delegation to the Fisheries Conference convened by the South Pacific Commission at Noumea. In 1957-58 he organized and directed a six weeks' Training Centre in Fisheries Cooperative and Administration, sponsored by FAO and held at Sydney and Adelaide, and attended by 26 participants from member countries of the Indo-Pacific Fisheries Council.

Dr. Geoffrey F. Fish, Biochemist, Fish Culture Research Station, Batu Berendam, Malacca, Federation of Malaya, has accepted an appointment at the Fisheries Laboratory, Te Wairoa Road, Rotorua, New Zealand. Dr. Fish who has done a considerable amount of research in Africa and later in Malacca, particularly with *Tilapia*, will take up his appointment in New Zealand in April 1960.

Mr. Chin Phui Kong, Assistant Fisheries Officer, Department of Agriculture, Jesselton, Conlony of North Borneo, has been granted a 6-month fellowship at the Chicago Natural History Museum under the sponsorship of the U.S. National Science Foundation. Mr. Chin will be working with Dr. Robert Inger of the Chicago Natural History Museum on a Monograph of the frashwater fishes of North Borneo and he expects to stay in U.S.A. from the middle of March 1960 until September 1960. Mr. Chin was intimately connected with the preparation of the 3 large collections of freshwater fishes now housed in the Chicago Natural Museum and which will form the besis of the Monograph.

Mr. R.J. LeBrasseur, a Canadian fisheries scientist of the Fisheries Research Board of Canada at Nanaimo, B.C., has been awarded the 1959 André Meyer Fellowship for Research in Fisheries. It is the first time that this award has gone to a Canadian. The fellowship, provided by the FAO will give Mr. Le Brasseur a year of study abroad. He will be given special leave from his post at the Research Board's Biological Station at Nanaimo. Mr. LeBrasseur, a graduate of the University of British Columbia, specializes in plankton research and ocean productivity, and has published extensively in this field.

CURRENT READING

UNESCO Marine Sciences Newsletter

The UNESCO Science Cooperation Office for Southeast Asia has issued its first Marine Sciences Newsletter which is dated November 1959. This new publication is issued in mimeographed form, the first copy containing 23 pages in quarto size. Following an introduction, the Newsletter contains a valuable report by Dr. Klaus Wyrtki on Physical Oceanography in the Central Indo-Pacific Region. This report reviews sources of information on oceanographic conditions and data for the area and draws attention to future needs in studying the oceanography of the Central Indo-Pacific. A very comprehensive list of references set out under subject heading is given. The Newsletter also contains references to the International Oceanographic Congress. The Conference on International Oceanographic Ships, the Center for Carbon-14 Determination and other matters of interest to fisheries and oceanography workers in the region. The UNESCO Marine Sciences Newsletter is available on request from the UNESCO Science Cooperation Office for Southeast Asia, Djalan Diponegoro 76, P.O. Box 2313, Djakarta, Indonesia.

The Application of Science to Inland Fisheries, FAO Fisheries Study No. 8, 52 pp. Price US $0.50.

In reviewing the biological bases of fish production in inland waters, this

study considers the limnological and ecological processes leading to the harvest of fish. It briefly summarizes the main lines of past research and suggests the future research emphasis should be on algal ecology, population ecology of fish food organisms, and the population dynamics and physiology of fish. The author, E.D. Le Cren, of the Freshwater Biological Association, England, describes what he considers to be the five main stages in the process of production and fish cropping in an aquatic environment. He discusses the physical and chemical factors influencing algal growth, as well as limnological factors affecting the supply of nutrients and differences in productivity between waters. Principal types of food eaten by fish are noted, with a description of the main features of the food chains of planktonic, benthis and littoral communities. The value of artificial feeding is also assessed. On the matter of relationships between fisheries and other human activities, the study includes mention of the possibilities of integrating aquatic and terrestrial farming and the influence of dams, reservoirs and water abstraction. Further reference along these lines is made to the influence of canals in the spread of aquatic species, the effect of pollution, sewage as a fertilizer, medical aspects of inland water, and recreational fisheries. Mr. Le Cren, whose opinion is that science can most help in the development of fisheries by providing some fundamental understanding of nature, ably defines the concept of the "production" of fish. His description of the survival, growth and production for a brood of fish emphasizes the importance of cropping at optimum size and rate. Causes of natural mortality and the importance of predator control are also covered. Administrators concerned with fisheries, while acquainting themselves with elements of the biological and technological bases of their industry, are advised to leave the administration of fishery research and the preliminary stages of its application to scientists. Although scientists may not always be right, the author feels they are more likely to provide the administrator with a rational and unprejudiced answer to his problem than anyone else who might be consulted.

Fisheries Bibliography

The **FAO Current Bibliography of Fisheries and Aquatic Sciences** which was undertaken by the Biology Branch, Fisheries Division, FAO, early in 1958 as a mimeographed publication, is now being published in the printed version from January 1960, by Messrs. Taylor and Francis, the London printers and publishers. It may be possible to supply back sets of mimeographed issues to subscribers who have not yet received them. It is expected that upwards of 12,000 publications would be listed annually and assistance is welcomed from users of the Bibliography, in the form of submission of reprints, accession lists, page proofs, abstracts, annotations, lists of references, etc.

Methods of Radiochemical Analysis

The Report of the Joint WHO/FAO Expert Committee on Methods of Radiochemical Analysis which met in Geneva from 15-20 September 1958 has now been published in two series, World Health Organization Technical Report Series No. 173 and FAO Atomic Energy Series No. 1 and is priced at US$1. The Report reviews, in considerable detail, sources of radioactive contamination and discusses problems of evaluation of environmental

and human contamination. A chapter on sampling of radionuclides is followed by a review of analytical methods applicable to the 12 important isotopes. The last chapter is devoted to instrumentation. In dealing with aquatic food products, the report states that organisms living in water areas are utilized as human food to a greater or lesser extent depending on local dietary habits. Aquatic organisms concentrate certain radionuclides either by direct uptake from water or from their food, or by direct passage through the epithelial membranes. There is a wide range of concentration depending upon the particular species, the particular tissues, and the radionuclide involved. For an evaluation of the hazard, it is useful to have information about the physical and biological cycling of radioelements in the aquatic environment and for a broad range of species. From the standpoint of practical public hygiene, the species to be analysed should be selected on the basis of their importance in the diet. However, in certain instances a food item that is eaten only in small quantities, e.g., fish viscera or seaweed, may make a relatively large contribution of radioactivity to the diet because it contains high concentrations of radionuclides. In Table No. III the radionuclides apparently of greatest interest are stated to be ^{89}Sr, ^{90}Sr, ^{137}Cs, ^{60}Ru, ^{65}Zn, $^{55,59}Fe$, $^{141,144}Ce$, and it is pointed out that attention must be given to concentration of specific radionuclides by various tissues and organisms. The reports goes on the state that in general, it appears that organisms of lower ecological order that obtain their nutrients directly from the water, such as plankton and aquatic weeds, show higher levels of radioactivity than carnivorous fish; there will be more chance of finding short-lived radionuclides in the lower ecological orders than in the higher orders because of the time-scale of feeding and metabolism. The samples of aquatic food products used for analysis should represent the product as nearly as possible in the condition in which it is consumed. Almost any radionuclide that is disseminated in water areas will be found in marine and freshwater products. Attention is called to the fact that many elements are highly concentrated by certain organisms, e.g., cobalt in mollusks, ruthenium in weeds, zinc, cadmium and iron in fish viscera, cerium in fish, calcium and strontium in bones and in shells of mollusks, and consequently relatively high concentrations of radionuclides of these elements may be found in specific tissues.

MEETINGS AND CONFERENCES

Symposium on the Classification of Brackish Waters

At the XIII Congress of the International Association of Limnology held in Helsinki from July 27th to August 7th 1956, on the proposal of Dr. Sven Segerstrale, the decision was taken to organise in Venice a Symposium on the Classification of Brackish Waters. The Symposium was sponsored and supported with a grant by the International Union of Biological Sciences (IUBS), to which the Limnological Society is connected as a Section. The Symposium was held in Venich at the Centro Nazionale di Studi Talassografici of the Consiglio Nazionale delle Ricerche from April 8th to 14th 1958. Papers were presented by Sven G.

Segerstrale, A. Remane, B. Havinga, L.A. Zenkevitch, M.C. Bacesco and C. Margineanu, G. Petit and D. Schachter, U. Ancona, J.W. Hedgpeth, L.C. Beadle, H. Caspers, D.J. Rochford, W. Schmitz, E. Dahl.

At the final session of the Venice Symposium a revised classification of marine waters according to salinity was adopted and recommended for universal application. It is a somewhat modified REDEKE-VALIKANGAS system, with the addition of zones for higher salinities in order to include the whole salinity range found in the marine region. The modification of the REDEKE-VALIKANGAS system (which was designed for the waters of northern Europe) is primarily confined to shifting the lower part of the mesohaline zone to the oligohaline zone, in order to express ecological conditions encountered in southern Europe, South Africa and some other areas. The term (brackish), as a classificatory term, was avoided because of its ambiguous meaning and the term (mixohaline) was proposed to indicate diluted sea water. In order to express more adequately the conditions in such areas, for example as found in lagoons on the Mediterranean coast, the term (mixoeuhaline) was coined to include those coastal waters which have a salinity falling within the euhaline range but are at the same time of lower salinity than the adjacent sea. For the sake of simplicity the various salinity zones have been defined by rather precise figures, but it was streased that these figures are approximate, as indicated by the use of the ~ sign.

The system adopted by the Symposium, with the appoximate salinity ranges, is as follows:

ZONE	Salinity (‰)(1)
Hyperhaline	> ~40
Euhaline	~40 – ~ 30
Mixohaline	(~40) ~30 – ~ 0.5
Mixoeuhaline	> ~ 30 < but adjacent euhaline sea
(Mixo-) polyhaline	~30 – ~ 18
(Mixo-) mesohaline	~ 18 – ~ 5
(Mixo-) oligohaline	~ 5 – ~0.5
Limnetic (freshwater)	< ~ 0.5

In view of the transitional character of the floral and faunal boundaries between zones within saline areas in nature, as well as their regional and local variation, any salinity classification can correspond only approximately with the zonation of the flora and fauna. It should also be remembered that references given even to the best possible system never give more than the average salinity conditions in a given water: additional details of the salinity range, both diurnal seasonal and annual, of the incidence of maxima and minima, and

(1) In this system the order and more familiar terms of the mixohaline series, polyhaline, etc., should be used in reference to the values of this system (the ((Venice system))), and authors are requested to indicate that they are suing this scheme in order to avoid misunderstanding.

other highly varying features of paramount ecological importance will always be necessary (cf. the halothermographs= hydroclimagraphs, by HEDGPETH, 1951, in : Rep. Committee Treatise Mar. Ecol. Paleoecol. 11, pp. 49-54).

In order to indicate waters of unstable or variable salinity (irrespective of mean values), the term ((poikilohalinity)) (adj. ((poikilohaline))), in a sense slightly modified from that of DAHL (1956, in Oikos 7, pp. 1-21), could be used. The condition of stable or constant salinity could then be described as ((homoiohalinity)) (adj. ((homoiohaline))). Explanatory terms of the type proposed by ROCHFORD (1951, in : Austr. J. Mar. Freshw. Res. 2, pp. 1-116) and R. SMITH (1857, in : Annee biol. 33 (1/2), pp. 93-107), might be useful. Subdivision of the adopted zones covering more local conditions, will also prove sueful or necessary in many cases. As an example, in the Baltic Sea the following subdivisions of the meso- and ologohaline zones, based on biological observations, are important:

(Mixo-)	mesohaline	
	α-mesohaline	$\sim$ 18 – $\sim$ 10
	β-mesohaline	$\sim$10 – $\sim$ 5
(Mixo-)	oligohaline	
	α-oligohaline	$\sim$ 5 – $\sim$ 3
	β-oligohaline	$\sim$ 3 – $\sim$ 0.5

In other cases, as, for example, the Australian estuaries which render any strict system inapplicable, reference to unversally adopted terms for waters of different salinity may at least facilitate description of areas and characterization of the fluctuation range.

It was agreed that any attempts to classify inland saline waters would be premature in view of our incomplete and scattered information, and the hope was expressed that some standard way of expressing the salt content of such waters could be adopted or recommended by the International Association of Limnology.

The papers, discussion and final resolution have been published in "Archivio di Oceanografia e Limnologia", Volume XI, 1959, as special Supplement, 248 pp., 37 figs.

FORTHCOMING FAO MEETINGS AND TRAINING CENTERS OF FISHERIES INTEREST

Date	Subject of Conference	Convening Body and/or Organizers	Location
	1960		
25-30 April	European Inland Fisheries Advisory Commission	Mr. Girard	Dublin
20-23 April	Conference on Microbiology of Irradiateo Foods	Dr. Silow & Mr. Holmes	Paris
3-7 May	Conference of Non-Governmental Organizations on Freedom-from-Hunger Campaign	Dr. Ezetiel	Rome
23-24 May (Tentative)	Continuing Working Party on Fisheries Statistics in the N.W. Atlantic Area	Fisheries Division	Bergen (Tentative)
24-30 Sept. (Tentative)	Technical Conference on Credit in Fishing Industry	Mr. Beever	Paris
22-28 Sept.	6th Session of the General Fisheries Council for the Maditerranean	Mr. Girard	Rome
17-28 Oct.	34th Session of the FAO Council	Mr. Veillet-Lavallee	Rome
14-23 Nov.	5th FAO Regional Conference for Asia and Far East	Mr. Ohtu	Saigon
2nd Half of 1960	Joint FAO/WHO Committee on Food Additives	Dr. Van Veen	Geneva
Last Quarter of 1960	9th Session of the Indo-Pacific Fisheries Council	Mr. Tubb	Karachi

TRAINING CENTERS OF SEMINARS

1 Feb-14March	Latin American Inland Fisheries Training Center	Dr. Beckmann	Buga, Colombia
1 Sept-27 Oct.	Fisheries Training Center (ETAP)	Mr. Lusyne	Suez
Oct. (8 days)	Seminar on Community Caming	Mr. Holmes	Poland

IMPORTANT IPFC PUBLICATIONS

PROCEEDINGS (Records of Council Sessions.)

*First Meeting, Singapore, 24 - 31 March 1959

Section I :	Report of Proceedings
Section II :	Working Papers
Section III :	Contributed Papers
Section IV :	Symposium Papers

Second Meeting, Cronulla, N.S.W., Australia, 17 - 28 April 1950

Section I:	Report of Proceedings
Section II :	Technical Papers
Section III :	Symposium Papers

Third Meeting, Madras, India, 1-16 February 1951

Section I :	Report of Proceedings
*Section II :	Technical Papers
*Section III :	Symposium Papers

Fourth Meeting, Quezon City, Philippines, 23 October - 7 November 1952

Section I :	Report of Proceedings
*Section II :	Technical Papers and Symposium Papers

Fifth Meeting, Bangkok, Thailand, 22 January - 5 February 1954

Section I :	Report of Proceedings
*Section II :	Technical Papers
Section III :	Symposium Papers

Sixth Session, Tokyo, Japan, 30 September - 14 October 1955

Section I :	Report of Proceedings
Section II :	Technical Papers
Section III :	Symposium Papers

Seventh Session, Bandung, Indonesia, 13 - 27 May 1957

Section I :	Report of Proceedings
Section II :	Technical Papers
Section III :	Symposium Papers

Eight Session, Colombo, Ceylon, 6 - 22 December 1958

Section I :	Report of Proceedings
Section II :	Technical Papers (in Press)
Section III :	Symposium Papers (in Press)

(* Items so marked are out of print.)

CURRENT AFFAIRS BULLETIN

No. 1-27, July 1951 - April 1960 (* 1-21, 23)

SPECIAL PUBLICATIONS (Irregular)

*No. 1: Schuster, W.H. (1952). Fish Culture in Brackish-water Ponds of Java. 1 - 143 pp.

*No. 2: Anonymous, (1952). Fish Culture in Indonesia. 1 - 126 pp.

No. 3: Zaneveld, J.S. (1955). Economic Marine Algae of Tropical South and East Asia and their Utilization. 1 - 55 pp.

No. 4: Anonymous, (1958). Annotated Bibliography on Fishing Gear and Methods.

MISCELLANEOUS

Directory of Fisheries Institutions—Asia and the Far East.

1959 OCCASIONAL PAPERS (Irregular, Mimeo)

*No. 59/1 A List of Commercial Fishes of Indonesia, by Mohd. Unar and M. Sachlan.

*No. 59/2 The Bank of Fishermen's Cooperatives, by Eddiwan.

No. 59/3 Synopsis of Biological Data on Milkfish *Chanos chanos* (Forskal), 1775, by W.H. Schuster.

No. 59/4 A List of Lake Plankton-Burma, by J.A. Tubb.

No. 59/5 Dissolved Oxygen Determinations Using a Polarograph Apparatus, by G.R. Fish.

No. 59/6 Fish Production and Consumption in West Java, by Rabdul Pahari.

No. 59/7 The Function and Significance of Fish Culture in Relation to the Regional/Village Economy, by R. Soekarno.

No. 59/8 Some Experiments on Tuna Fishing with a New Method in the Indonesian Waters, by Mohammad Unar.

No. 59/9 A Method for Plankton Volume Determination, by D.J. Tranter.

No. 59/10 The Philippines Measuring Board, by B.Y. Datingaling.

*No. 59/11 The Use of Pituitary Hormones in Fish Culture (reprinted from *Endeavour*), by J.W. Atz and Grace E. Pickford.

No. 59/12 Method Used for Separating and Counting the Eggs in Fecundity Studies on the Plaice (*Pleuronectes platessa*) and Herring (*Clupea harengus*), by A.C. Simpson.

(* Items so marked are out of print.)

PRINTED AT PRACHANDRA PRINTING PRESS, MAHARAJA ROAD, BANGKOK, THAILAND.
MR. SANAN BUNYASIRIBHANDHU, PROPRIETOR, PRINTER AND PUBLISHER 1960.